Regional Climate Studies with Variable-Resolution GCMs

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Variable-resolution stretched-grid (SG) GCMs using a global stretched grid with enhanced regional resolution represent a viable new approach to regional climate and climate change studies and applications. The SG-approach is an ideal tool for representing consistent interactions of global and regional scales. Under this research effort, the SG-GCMs are being investigated in collaboration with the Canadian (RPN and UQAM) groups (see their separate talk).

The SG-GCM simulations are performed for seasonal, annual, and multiyear time scales with 40, 50, and 60 km regional resolution. Seasonal simulations are produced for the anomalous U.S. summer events of 1988, 1993, and 1998. The annual (Nov.1997-Dec.1998) simulation is performed with the new SG-design, with multiple (four) areas of interest including the major monsoonal circulations: North American, South American, Indian, Asian, and Australian. The 12-year AMIP-type SG-GCM simulation is performed for the 1986-1998 period that includes the recent ENSO cycles. These experiments show the potential of the SG-approach for representing seasonal-to-interannual as well as long-term regional climate variability and predictability.

Two new SG-GCMs are being developed as a collaborative effort. The first is the SG-version of the new NASA/NCAR FV-GCM (with the finite-volume (FV) Lin-Rood dynamics), and the second (in collaboration with F.Baer, A.Fournier, J.Tribbia) is the SG-version of the new GCM with spectral-element dynamics. Both GCMs use the NCAR CCM4 physics. Using these advanced numerical techniques will provide increased computational efficiency for the new SG-GCMs that will make possible to use finer, 25-30 km, regional resolution for long-term climate and climate change experiments.

Recent (2000-2001) publications

Fox-Rabinovitz, M. S., G.L. Stenchikov, M.J. Suarez, L.L. Takacs, and R.C. Govindaraju, 2000: A Uniform and Variable Resolution GCM Dynamical Core with Realistic Orography, Mon. Wea. Rev., Vol. 128, No. 6, 1883-1898.

Fox-Rabinovitz, M. S., 2000: Regional climate simulation of the anomalous U.S. summer events using a variable-resolution stretched-grid GCM, J. Geophys. Res, Vol. 105, No. D24, p. 29,635-29,646.

Fox-Rabinovitz, M. S., L.L. Takacs, M.J. Suarez, and R.C. Govindaraju, 2001: A Variable Resolution Stretched Grid GCM: Regional Climate Simulation, Mon. Wea. Rev., Vol. 129, No. 3, pp. 453-469.

Fox-Rabinovitz, M. S., L.L. Takacs, and R.C. Govindaraju, 2001: A Variable-Resolution Stretched-Grid GCM and DAS with Multiple Areas of Interest: Studying the Anomalous Regional Climate Events of 1998, submitted.

Fox-Rabinovitz, M. S., and E. H. Berbery, 2001: Simulation of the North American Monsoon System and its Link to Midwest Precipitation Using a Variable-Resolution Stretched-Grid GCM, to be submitted.